Separators for improved grinding performance

Separators or classifiers can be key to optimising performance of grinding systems in cement plants as well as ensuring product quality targets are delivered. Modern third-generation separators are delivering significant grinding improvements in new and existing grinding systems.

■ *by **Intercem Engineering**, Germany*

Modern separators can significantly enhance the performance of a closed-circuit grinding system in a cement plant

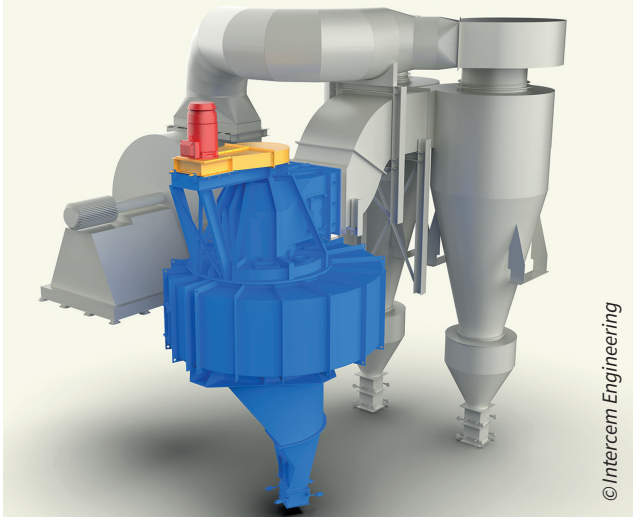
As ball mills work in a closed circuit, the highly efficient separation of fines and finished product is required to optimise grinding performance and ensure a high quality of the finished product. To achieve this, cement plants use high-efficiency separators in the cement mill circuit.

Modern high-efficiency separators can deliver a homogeneous grain size distribution and high precision in separation as well as the possibility to produce several cement types in one grinding circuit.

To fulfill these criteria, Intercem has developed a range of different classifier types:

- **ICV high-efficiency vertical separator** Inflow of the process air including the mill dedusting air during cement separation via a process filter
- **ICS high-efficiency separator** with tangentially-fed airflow and upper and lower bearing, accessible from outside for maintenance. This type of separator is used for the separation of mill discharge material and cement separation via high-efficiency cyclones or process filters
- **ICD vertical air separator** for the use and optimisation of vertical mills.

ICS high-efficiency separator with tangentially-fed airflow



Process description

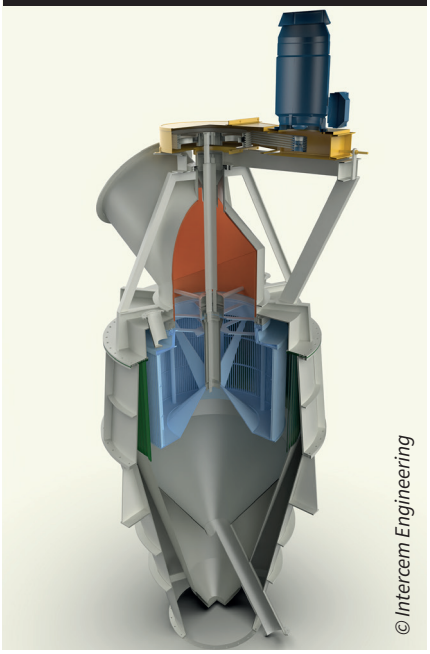
At the top of the separator, there are two inlet points where the material enters the separator. The mill discharge material is fed to the upper part of the rotary basket and the distribution table, which is designed to enable optimum distribution of the separator feed material to the separator cone.

The material is fed into the dispersion zone, which is located between the rotor and the guide plates. This is supported by the rotation of the cage.

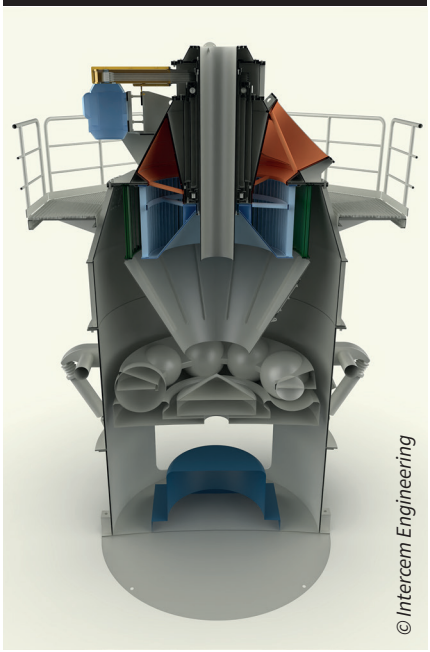
Permanent pressurisation of the air seal with sealing air prevents oversized particles from entering the flow of fine particles and keeps the area between the sealing rings almost free of material.

Intercem has modified the separator system with the aim of increasing efficiency. The coarse cement should remain in the separation zone for as long as possible to ensure the best possible deagglomeration of the coarse and fine particles. This is achieved by material retention devices in the separation zone. The force of impact on the cone of the wear-protected rotor causes agglomerates to break up and larger particles to be crushed.

ICV high-efficiency separator



ICD high-efficiency separator



Coarse particles (grit) are partially accelerated by the rotor, caught by the guide vanes and separated by the collector in the lower part of the separator, which is protected by a homogeneous wear protection system.

The fineness of the product is set via the speed of the rotor and the air speed, while the air flow is kept constant at the specified output for a multitude of cement qualities. The circulating air flow is only reduced if necessary for very fine qualities.

It is essential that the width of the separation zone is adapted. The configuration of the rotary cage in the slide and the air guide vanes of the stationary elements also have a major influence.

The latest available technology ensures a continuous improvement in separation performance.

Table 1: grinding performance after installing a ICS high-efficiency separator at a Tunisian cement plant

	Before optimisation	After optimisation
Throughput performance (tph)	125 at 3000cm²/g	148.3 at 3350cm²/g
Throughput performance at comparable fineness – 3000cm²/g (tph)	-	176.3
Performance improvement (%)	-	+41.0
Energy demand (kWh/t)	33.6	23.8
Energy demand improvement at comparable throughput – 176.3tph (%)		-29.2

Table 2: grinding performance after installing a ICV high-efficiency separator at a Tunisian cement plant

	Before optimisation	After optimisation
Throughput performance (tph)	70 at 3200cm²/g	81.7 at 3300cm²/g
Throughput performance at comparable fineness – 3200cm²/g (tph)	-	85.8
Performance improvement (%)	-	+22.6
Energy demand (kWh/t)	41.1	31.3
Energy demand improvement at comparable throughput – 176.3tph (%)		-23.8

Product benefits

Intercem modern high-efficiency separators have the following advantages:

- survey of the separator bearing by temperature- and vibration measurement
- V-belt drive
- confined air sealing between rotating cage and lower housing
- robust construction due to mature development
- wear-protected separator elements – long lifetime of wear parts
- central lubrication
- easy accessibility to the upper and lower cage bearings, guide vanes and other wear parts
- minimal maintenance.

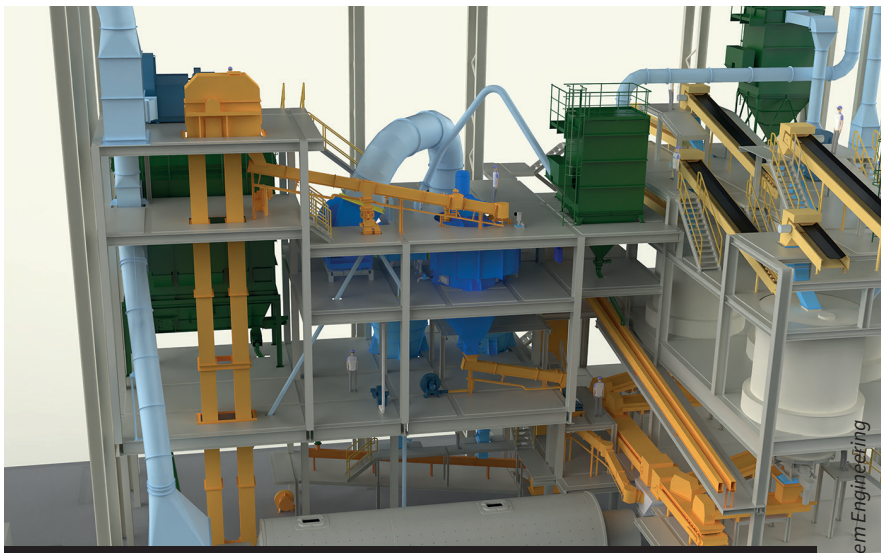
Moreover, the compact construction of the high-performance separator enables the replacement of old separator types and connection with further plant components on the same footprint. Complex and cost-intensive interventions into existing buildings are omitted.

ICS high-efficiency separator for new grinding unit

A construction company in eastern Europe, which also produces precast concrete parts and lime products, planned to invest in a new cement production line. The new line was initially planned with one cement grinding unit (based on a classic EGL ball mill of ϕ4.0x13.5m) and two cement silos with truck loading. However, the project included the option to extend the grinding plant with an additional cement grinding unit in the mill building and to double the number of cement silos.

For this grinding project, the construction company awarded the contract to Intercem Engineering, based on the supplier's high level of expertise, experience and customer support prior to investment. Under the contract, Intercem was required to supply the core of the grinding circuit, the separator, cyclones, separator fan and circulation units. This also included the engineering for the complete grinding plant as well as assembly supervision and commissioning of the components.

To optimise grinding performance at the plant, the customer required a tailor-made solution and therefore, Intercem produced an ICS plus 145 high-efficiency separator as well as the associated equipment. The high-efficiency separator, an in-house development manufactured in Intercem's workshop, has a capacity of



An ICS plus 145 high-efficiency separator and associated equipment was installed at a construction company's new cement production line to optimise its grinding output

115tph at 3000cm²/g according to Blaine and a total output of 258tph. The volume flow of classifying air is approximately 145,000m³/h.

Replacing an existing separator

ICS high-efficiency separator

A project in Tunisia saw the replacement of an existing second-generation cyclone air separator by a third-generation ICS high-efficiency separator.

After the measuring of the complete plant with a 3D scan, the engineering of the new separator and the associated piping arrangement leading into the existing building was started. In Intercem's workshop in Oelde, Germany, the key components – such as rotating cage, bearings, V-belt drive, guide vanes, drive shaft, etc. – were manufactured, whereas sheet metal parts were produced by local manufacturers in Tunisia, using workshop drawings supplied by Intercem. All parts were then assembled and fixed on site in compliance with international standards.

The customer confirmed the efficiency of the new third-generation separator. The Tromp curve for 3350cm²/g according to Blaine, as analysed by VDZ, and the comparison of results before and after the optimisation show an excellent performance when grinding clinker to produce CEM II 42.5 R cement (see Table 1).

The bypass-rate is 11 per cent at 4500cm²/g for this project and therefore the separator replacement led to significant improvement of grinding performance and product quality.

Vertical high-efficiency separator

In a separate project in the same country, Intercem replaced an existing second-generation cyclone air separator with a third-generation ICV high-efficiency vertical separator. In addition to the supply of the ICV separator, Intercem's scope of supply and services included the delivery of various mechanical and electrical equipment, the dismantling of the old and the erection of the new equipment, performance tests, and the mechanical and electrical commissioning.

The first step required the measurement of the complete plant by state-of-the-art 3D scans as no plans or drawings of the plan existed. This would enable exact engineering and a problem-free erection of the new separator. This was followed by the engineering of the separator and the piping arrangement into the existing building before the manufacturing process started.

As in the case of the previous example, the separator key components – rotating cage, V-belt drive, bearings, drive shaft – were manufactured in the Intercem workshop in Germany while some sheet metal parts were produced by local manufacturers according to Intercem's workshop drawings.

On a Tromp curve, you can observe the so-called "bypass level". The bypass level indicates what percentage of fine particles go to the coarse stream. This measures inefficiency. With a bypass rate of 11 per cent at 4500cm²/g, the new ICV separator achieved an excellent value.

Increased grinding efficiency

The use of third-generation classifiers in the grinding process enables cement plants to achieve a higher grinding output. In addition, these systems operate at a reduced specific energy consumption, leading to a significant reduction in electricity costs for cement producers. ■

Key components such as the separator's spiral cage and its housing (right) and the lower part of the housing, the reject collector (below), are manufactured in Intercem Engineering's workshop in Oelde, Germany